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Nonlinear Ultrasonic Resonance Spectroscopy of Intact Carbon Fiber/Epoxy Composites**Sunil Kishore Chakrapani**¹, Daniel J Barnard¹, and Vinay Dayal², ¹Center for Nondestructive Evaluation, Iowa State University; ²Department of aerospace Engineering, Iowa State University

The present study reports the influence of fiber orientation, laminate sequence and fabric type on the inherent nonlinearity of intact carbon fiber/epoxy composites using nonlinear resonant ultrasonic spectroscopy (NRUS) [1-2]. Fiber orientation of the CFRP samples were changed relative to the length of the sample. Since the fundamental flexural mode is excited, the properties of the composite along the length of the sample would influence the nonlinear response [3]. Two hypothesis were developed using the orientation results and theory of interlaminar stress. Additionally four different laminate sequences were also tested to study the influence of laminate sequence on the inherent nonlinear response. Finally the effect of fabric type was investigated by comparing the nonlinearity of woven fabric and continuous fabric [4]. For each case comparisons were made by capturing the frequency shifts, modal damping ratios, and higher harmonics. The hypotheses were tested using the NRUS results for the laminate sequence and fabric study. Conjectures for physical interpretation were developed using these results.

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References:

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